Use on projects with any of the following bid items:

Concrete Masonry Bridges, Concrete Masonry Bridges HES
Concrete Masonry Seal
Concrete Masonry Culverts, Concrete Masonry Culverts HES
Concrete Masonry Retaining Walls, Concrete Masonry Retaining Walls HES

QMP Concrete Structures; Incentive Strength Concrete Structures, Item 502.0400.S.

A Description

A.1 General

(1) Conform to standard spec 501, 502, and 504 as modified in this special provision. Apply this special provision to all cast in place concrete placed under the following bid items:

502.0100	Concrete Masonry Bridges
502.0200	Concrete Masonry Bridges HES
502.1100	Concrete Masonry Seal
504.0100	Concrete Masonry Culverts
504.0200	Concrete Masonry Culverts HES
504.0500	Concrete Masonry Retaining Walls
504.0600	Concrete Masonry Retaining Walls HES

(2) Provide and maintain a quality control program, defined as all activities and documentation of the following:

1. Mix design.
2. Production control, placement control, and inspection.
3. Sampling, testing, and making necessary adjustments related to the production of ready-mixed concrete conforming to the contract.

(3) Chapter 4 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required sampling and testing procedures. The contractor may obtain the CMM from the department's web site at:

http://roadwaystandards.dot.wi.gov/standards/cmm/index.htm

(4) The department's Materials Reporting System (MRS) software allows contractors to submit data to the department electronically, estimate pay adjustments, and print selected reports. Qualified personnel may obtain MRS software from the department's web site at:

http://www.atwoodsystems.com/mrs/

A.2 Pre-Pour Meetings

(1) Arrange at least 2 pre-pour meetings to discuss concrete placement. Discuss the placement schedule, personnel roles and responsibilities, testing and quality control, and how test results will be communicated. Schedule the first meeting before placing any concrete and the second before placing any bridge deck concrete. Ensure that representatives from all parties involved with concrete work, including contractor, sub-contractor, ready mix supplier, testers, and the project manager, attend these meetings.

A.3 Contractor Testing for Small Quantities

(1) The department defines a small quantity for each individual applicable bid item, as a plan quantity of 150 cubic yards (114.7 m^3) or less of concrete as shown in the schedule of items under that bid item.

(2) The requirements under this special provision apply equally to a small quantity for an individual bid item except as follows:

1. The contractor need not submit a full quality control plan but shall provide an organizational chart to the engineer including names, telephone numbers, and current certifications of all persons involved in the quality control program.
2. The engineer may accept aggregate gradation based upon one or both of the following:
   - Satisfactory records of previous testing.
   - At least one test performed before beginning concrete production.
3. Divide the concrete placed under each bid item into approximately uniformly sized sublots as follows:

QUANTITY PLACED	MINIMUM REQUIRED NUMBER OF SUBLOTS[1]
≤ 50 cubic yards (38.2 m^3)	One sublot
> 50 cubic yards (38.2 m^3) and ≤ 100 cubic yards(76.5 m^3)	Two sublots
> 100 cubic yards (76.5 m^3) and ≤ 150 cubic yards(114.7 m^3)	Three sublots

[1] If the quantity placed overruns 150 cubic yards (114.7 m^3), create overrun sublots to test at a rate of one additional sublot for 50 cubic yards (38.2 m^3), or fraction of 50 cubic yards (38.2 m^3), of overrun.

4. No concrete control charts are required. Submit test results to the engineer each day as they become available. Assure that all properties are within the limits specified in the standard specifications for each sublot tested and that the sublot compressive strength equals or exceeds f'c.

B Materials

B.1 Quality Control Plan

(1) Submit a comprehensive written quality control plan. Construct the project as the plan provides. Submit the plan to the engineer no later than 10 business days before placing concrete. Do not begin concrete production or change the quality control plan without the engineer's review. Update the plan with changes as they become effective. Provide a current copy of the plan to the engineer and post in each of the contractor's laboratories before producing concrete and as changes are adopted. Ensure that the plan provides the following elements:

1. An organizational chart including names, telephone numbers, current certifications and/or titles, and roles and responsibilities of all QC personnel.
2. The process by which quality control information and corrective action efforts will be disseminated to the appropriate persons including materials suppliers.

Include a list of recipients, the communication means that will be used, action time frames, and report formats.

3. Preliminary mix information including anticipated producers, manufacturers, and sources of mix materials, and the name, title, and phone number of the person responsible for developing the mix design.
4. The locations of the QC laboratories for mix design, aggregate testing, cylinder curing, concrete testing, and compressive strength testing. Include a description of the sampling and testing equipment.
5. Aggregate information including production and handling operations; how contamination, segregation, and degradation will be minimized; and anticipated concrete mix aggregate gradations and limits.
6. The procedures for delivering, storing, and managing all mix materials.
7. Facilities, procedures, and controls used to produce a mix conforming to the specifications and the mix design.
8. The equipment, times, and methods used to deliver the concrete mix to the work site and to the point of placement.
9. The initial and routine equipment checks and documentation performed on scales, water meters, admixture dispensers; and delivery, placing, surfacing, and curing equipment..
10. The methods for monitoring and recording the materials used in each batch.
11. The equipment and procedures for placing concrete and controlling the alignment, profile, cross slope, and thickness.
12. The procedures that will be employed to correct problems as they occur.
13. A description of the methods for finishing, texturing, and curing concrete.
14. The types, standards, and frequency for contractor quality control (QC) testing. Conform to B.7 of this special provision and include, but do not limit discussion to, the following:
    - The number of tests performed for aggregate gradations, moisture and fines; air content, temperature, slump, and compressive strength.
    - Procedures for checking and documenting steel cover including locations and testing methods.
    - Procedures for checking and documenting surface smoothness.
    - Proposed corrective actions for each tested property.
15. The lot layouts for compressive strength evaluation.
16. Provisions for responding to adverse weather conditions; such as precipitation, and hot and/or cold weather placement.

B.2 Personnel

(1) Perform the material sampling, testing, and documentation required under this provision using HTCP certified technicians. Have a PCC technician certified under HTCP at level I present at the project site, prepared and equipped to perform required sampling and testing whenever placing concrete.

B.3 Laboratory

(1) Perform the concrete mix design, aggregate testing, cylinder curing, and compressive strength testing at a department-qualified laboratory. Obtain information on the Wisconsin laboratory qualification program from:

Materials Management Section
3502 Kinsman Blvd.
Madison Wisconsin 53704
Telephone: 608-246-5388
http://www.dot.state.wi.us/business/engrserv/lab-qualification.htm

B.4 Equipment

(1) Furnish the necessary equipment and supplies for performing quality control testing. The engineer may inspect the measuring and testing devices to confirm both calibration and condition. Calibrate all testing equipment according to the CMM 4-15-12 and maintain a calibration record at the laboratory.

B.5 Concrete Masonry Mixes

B.5.1 General

(1) Have a PCC technician certified under HTCP at level II develop new concrete mixes for structures on the project. Test new mixes at a department-qualified laboratory. Alternatively the contractor may submit established mixes qualified exclusively by field performance.

(2) At least 3 business days before producing concrete, submit to the engineer 2 copies of a concrete mix report. Include signature blocks for both the contractor's mix developer and the department's project engineer on the mix report cover sheet. Before the engineer's review, have the mix developer sign and date each copy attesting that all information in the report is accurate and true. The engineer will review, comment, sign, and date each copy of the report. The engineer's signature will verify that the engineer had the opportunity to review the mix report, to check that it meets the concrete mix requirements, and to comment. The engineer will keep one original signed copy and return the other copy to the contractor within 3 business days of receiving the report.

B.5.2 Concrete Mix Design

B.5.2.1 General

(1) Delete standard spec 501.2.5.3.4, 501.2.5.4.4, 501.3.2.1, 501.3.2.2, and 501.3.2.3. Delete the maximum limit for material passing the No. 200 (75 μm) sieve from standard spec 501.2.5.3.1 and 501.2.5.4.2.

(2) For all bridge superstructure and substructure concrete, use a mix grade containing fly ash (A-FA), slag (A-S), both fly ash and slag (A-T), or blended cement (A-IP or A-IS).

(3) For concrete seals, use a grade D mix and construction methods conforming to standard spec 501 and 502.

B.5.2.2 Documentation

(1) Provide mix design documentation ensuring that all materials conform to standard spec 501.2, as modified in this special provision, unless the engineer waives specific requirements. Include documentation for contractor mix designs as follows:

1. Mix development: test dates, the name and location of the laboratory used to develop the mix design.
2. Mix: quantities per cubic yard expressed as SSD weights and net water, water to cementitious material ratio, air content, and 28-day or earlier compressive strength.
3. Materials: type, brand, and source.
4. Aggregates: absorption, specific gravities, wear, soundness, freeze thaw test results if required, air correction factor, and proposed gradation control limits.

B.5.2.3 Concrete Mix Physical Requirements

(1) Qualify compressive strength according to ACI Code 318 chapter 5 subsections 5.3.1 through 5.3.3 and 5.5. Use either laboratory strength data for new mixes or field strength data for established mixes. Demonstrate that the 28-day compressive strength of the proposed mix will equal or exceed the 90 percent within limits criterion specified in E.3.

(2) Ensure that the cementitious content for grade A concrete equals or exceeds 565 pounds per cubic yard (335 kg/m3). For all superstructure and substructure concrete, unless the engineer approves otherwise in writing, conform to one of the following:

1. Use class C fly ash or grade 100 or 120 slag as a partial replacement for Portland cement. For binary mixes use 15% to 30% fly ash or 20% to 30% slag. For ternary mixes use 15% to 30% fly ash plus slag in combination. Percentages are stated as percent by weight of the total cementitious material in the mix.
2. Use a type IP, IS, or I(SM) blended cement.

(3) The target ratio of net water to cementitious material (W/Cm) for the submitted mix design shall not exceed 0.45 by weight. Net water includes free water on the aggregate surface but does not include water absorbed within the aggregate particles. Control the W/Cm ratio throughout production by adjusting batch weights for changes in the aggregate moisture as required under B.7.3.2.

(4) Ensure that the combined aggregate gradation conforms to the following, expressed as weight percentages of the total aggregate:

1. One hundred percent passes the 2 inch (50 mm) sieve.
2. The percent passing the 1 inch (25 mm) sieve is less than or equal to 89. The engineer may waive this requirement where the clear spacing between reinforcing bars is less than 2 inches (50 mm).
3. The percent passing the No. 4 (4.75 mm) sieve is less than or equal to 42, except if the coarse aggregate is completely composed of crushed stone, up to 47 percent may pass the No. 4 (4.75 mm) sieve.
4. The percent passing the No. 200 (75 μm) sieve is less than or equal to 2.3 percent.

(5) Do not use any chemical admixtures, other than air-entraining agents or water reducers from the department's approved products list, without conforming to the following:

1. Obtain the engineer's approval in advance.
2. Document, by independent laboratory test reports, that the admixture conforms to AASHTO M 194.

(6) Do not use mixes containing chloride based accelerators. The contractor may use mixes containing non-chloride accelerators in substructure elements only.

B.5.3 Mix Changes

(1) Prepare and submit changes to a concrete mix to the engineer for review before using that mix. Changes requiring the engineer's review include:

1. Source of any material.
2. Amounts of cementitious materials.
3. Adjustment of fine to total aggregate greater than ±3 percent by weight.
4. Admixtures used in the mix.

(2) Adjusting admixture dosages does not require the engineer's review.

B.6 Quality Control Documentation

B.6.1 Control Charts

(1) Maintain control charts when required by the test reporting procedures. Ensure that all test results are recorded and become part of the project records. Plot required test results on the control charts. Include random, non-random, and engineer requested testing but only include the contractor’s randomly selected QC test results in the 4-point running average. The contractor may plot other contractor-performed process control or informational test results on the control charts, but do not include them in 4-point running averages.

(2) Post control charts in an engineer-approved location both on the project and at the concrete production site. Update control charts daily. Ensure that the control charts include the project number, the test number, each test element, the applicable warning and control limits, the contractor’s individual test results, the running average of the last 4 data points, and the engineer’s verification and independent assurance test data points. Use the control charts as part of a process control system for identifying potential problems and assignable causes. Format control charts according to CMM 4-15-12.

(3) Submit control charts to the engineer in a neat and orderly manner within 10 days after completing concrete production.

B.6.2 Records

(1) Document all observations, inspection records, mix adjustments, and test results daily. Submit test results to the department electronically using the MRS software. Complete all required data entry fields. Record other test results using the forms provided in CMM 4-15-42. Note other information in a permanent field record and, if appropriate, plot on control charts.

(2) Submit original testing records to the engineer in a neat and orderly manner within ten days after completing concrete production.

B.7 Contractor Testing

B.7.1 General

(1) Perform all contractor tests required under this special provision as well as additional contractor testing described in the quality control plan. Use the test methods identified below or other engineer-approved methods to perform the following tests:

Aggregate Gradations .....AASHTO T-11[1] & T-27[1]
Aggregate materials finer than the No. 200 sieve..... AASHTO T 11[1]
Aggregate moisture..... AASHTO T 255[1]
Air content ..... AASHTO T 152[2]
Slump ..... AASHTO T 119[2]
Temperature .....AASHTO T 309
Compressive strength..... AASHTO T 22, T 23, T 141, M 201

[1] As modified in CMM 4-25-50.
[2] As modified in CMM 4-25-70.

(2) The department may periodically observe contractor sampling and testing, and direct additional contractor sampling and testing for department evaluation. Ensure that all test results are available for the engineer's review at any time during normal working hours.

B.7.2 Aggregate Gradation

B.7.2.1 Sampling and Testing

(1) Randomly sample and test the individual aggregate gradations according to AASHTO T 11 and AASHTO T 27 as modified by the department. Have an HTCP certified aggregate sampling technician or aggregate technician IPP perform all sampling. Have an HTCP certified aggregate technician IPP test the aggregate and document the results.

(2) Test during aggregate production as follows:

DAILY AGGREGATE PRODUCTION in tons or Mg	MINIMUM FREQUENCY PER STOCKPILE tests per day
≤ 1000	1
> 1000 - ≤ 2000	2
> 2000	3

(3) If the aggregate was produced before the contract and production records are not available or not acceptable to the engineer, test during concrete production. Test each stockpile conforming to whichever of the following is most frequent:

- Once for each 250 cubic yards (200 m3) of concrete produced for WisDOT projects.
- Once per workweek while producing concrete for WisDOT projects.

(4) For testing performed during aggregate production, conform to the individual gradation limits documented in the contractor's quality control plan for the coarse and fine aggregate fractions. For testing performed during concrete production, conform to the combined gradation limits documented in the contractor's quality control plan.

(5) Ensure that only results of randomly selected QC tests are included in the 4-point running average.

(6) Use control limits for sieve sizes as identified in contractor's quality control plan. Gradation warning limits are inside the upper and lower control limit values by one percentage point for all sieves except as follows:

1. The upper warning limits for percent passing the No. 100 (150 μm) and No. 200 (75 μm) sieves are inside the control limit by 0.5 percent.
2. For sieves allowing 100 percent passing, there is no upper warning limit. For sieves with 0 percent passing, there is no lower warning limit.

(7) Wash each sample of fine aggregate and the first 4 samples of each of the coarse aggregates. If the percent passing the No. 200 (75 μm) sieve for the combined gradation is less than the warning limit, wash at least every 10th sample of each of the coarse aggregates. If the percent passing the No. 200 (75 μm) sieve for the combined gradation is greater than or equal to the warning limit, wash each sample of the coarse aggregate until 4 consecutive tests are less than the warning limit.

B.7.2.2 Documentation

(1) Maintain control charts at the laboratory for each aggregate stockpile. Maintain a chart for each control sieve for each material. Record contractor test results the same day tests are conducted.

B.7.2.3 Corrective Action

(1) When the 4-point running average value approaches a warning limit, consider corrective action. Ensure that any corrective action is documented and becomes part of the project records.

(2) Document whenever a 4-point running average exceeds the warning limits. When a second consecutive running average value exceeds the warning limits, take corrective action. Continue corrective action until 2 consecutive average points are within the warning limits.

(3) Notify the engineer whenever an individual test value exceeds a control limit. Material is nonconforming if an individual test result exceeds the control limit. The quantity of nonconforming material includes the material of the first test exceeding the control limit, continuing to but not including, the material from the first subsequent test that is within the control limits. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

B.7.3 Aggregate Sampling and Testing During Concrete Production

B.7.3.1 General

(1) Have an HTCP certified aggregate sampling technician or aggregate technician IPP perform all sampling. Have an HTCP certified aggregate technician IPP test the aggregate and document the results.

B.7.3.2 Aggregate Moisture Content

(1) Determine aggregate moisture content according to AASHTO T 255. The contractor may use the same sample used for the percent passing the No. 200 (75 μm) sieve testing.

(2) Measure and record the fine and coarse aggregate moisture content whenever conditions change. Test at least once for each 50 cubic yards (38.2 m^3) of concrete produced for WisDOT projects, except one test per day is sufficient under constant conditions. Record the time the sample was taken on the combined percent passing the No. 200 (75 μm) sieve control chart.

(3) Calculate target batch weights for each mix when production of that mix begins. Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5 percent, adjust the batch weights to maintain the design W/Cm ratio.

B.7.3.3 Aggregate Percent Passing the No. 200 Sieve

B.7.3.3.1 Sampling and Testing

(1) Determine the percent passing the No. 200 (75 μm) sieve for both fine and coarse aggregates according to AASHTO T 11 as modified by the department.

(2) Initially, test at least once for each 50 cubic yards (38.2 m^3) of concrete produced for WisDOT projects, except one test per day is sufficient for constant mix conditions. When 2 consecutive 4-point running averages are below the warning limit, the engineer may allow reduced testing down to a minimum of once per 5 days of concrete production. If a subsequent individual test exceeds the warning limit, return to the initial frequency.

(3) Document results on a combined gradation control chart for the percent passing the No. 200 (75 μm) sieve. Use the control limits defined in the contractor's quality control plan or mix design report. Ensure that only results of QC tests are included in the 4-point running average.

B.7.3.3.2 Corrective Action

(1) When an individual test approaches a warning limit, consider corrective action. Document corrective actions and include that documentation in the project records.

(2) Notify the engineer if an individual test exceeds the warning limits. If a second consecutive individual test exceeds the warning limits, the engineer and contractor will determine the contractor's course of corrective action. If the corrective action improves the property in question such that additional individual tests are within the warning limits, the contractor may continue production. If the correction does not improve the property, and new individual tests stay in the warning band, repeat the steps outlined here in B.7.3.3(2) starting with notifying the engineer.

(3) Notify the engineer whenever an individual test value exceeds a control limit. Material is nonconforming when an individual test exceeds the control limit. The quantity of nonconforming material includes the material of the first test exceeding the control limit, continuing to but not including, the material from the first subsequent test that is within the control limits. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

B.7.4 Compressive Strength

(1) The department will make pay adjustments for compressive strength on a lot-by-lot basis using the compressive strength of contractor QC cylinders. The department will accept or reject concrete on a sublot-by-sublot basis evaluating material for removal and replacement based on core strengths. There is no strength requirement for grade D concrete placed under the Concrete Masonry Seal bid item.

(2) Have an HTCP certified PCC technician I sample or observe sampling, fabricate cylinders, perform initial curing, and handle unhardened cylinders. Have a department qualified laboratory moist cure cylinders and cores. Have an HTCP certified concrete compressive strength tester, working in a department-qualified laboratory, perform cylinder and core compression tests.

B.7.4.1 Lot and Sublot Requirements

(1) Designate the location and size of all lots for the project before placing concrete. Ensure that no lot contains concrete of more than one mix, as defined in B.5.3, and does not exceed 500 cubic yards (400 m^3). Designate separate lots for structural concrete deposited underwater.

(2) Divide each lot into sublots 50 cubic yards (38.2 m^3) or smaller. Do not designate more than one sublot per truckload of concrete.

B.7.4.2 Sampling

(1) Have a certified technician determine random sublot sampling locations as described in CMM 4-15-12. Sample at the point of placement and according to AASHTO T 141. Collect enough concrete to fabricate three 6-inch by 12-inch (150 mm x 300 mm) cylinders; test air content, slump, and temperature; and where needed, additional concrete to fabricate 3 companion cylinders.

(2) Cast and initially cure cylinders according AASHTO T 23. Mark each cylinder to identify the lot and sublot it represents.

(3) For one sublot per lot, fabricate 3 companion cylinders from the same sample used for casting the QC cylinders. Provide all materials, fabrication, initial curing, and handling required for companion cylinders for up to 3 calendar days following fabrication.

B.7.4.3 Concrete Cylinder Curing

(1) Provide initial field curing for up to 48 hours. Between 24 and 48 hours after fabrication, transport the cylinders to a laboratory for standard curing according to AASHTO M 201.

B.7.4.4 Compressive Strength Testing

(1) Have an HTCP certified compressive strength tester in a department-qualified laboratory, perform compressive strength testing and document the results. Randomly select 2 QC cylinders to test at 28 days for percent within limits (PWL).

(2) Determine the compressive strength in psi for each cylinder according to AASHTO T 22. Test each cylinder to failure. Use a compression machine that automatically records the date, time, rate of loading, and maximum load for each cylinder. Include a printout of this information with the strength documentation for each cylinder tested.

(3) Compare the strengths of the 2 randomly selected QC cylinders and determine the 28-day sublot average strength as follows:

- If the lower strength divided by the higher strength is 0.9 or more, average the 2 QC cylinders.
- If the lower strength divided by the higher strength is less than 0.9, break one additional cylinder and average the 2 higher strength cylinders.

B.7.4.5 Removal and Replacement

(1) The department will evaluate the sublot for possible removal and replacement if the 28-day sublot average strength is lower than f'c minus 500 psi (3.5 MPa). The value of f'c is the design stress the plans show. The department may assess further strength penalty or require removal and replacement only after coring the sublot.

(2) The engineer may initially evaluate the sublot strength using a non-destructive method. Based on the results of non-destructive testing, the department may accept the sublot at the previously determined pay for the lot, or direct the contractor to core the sublot.

(3) If the engineer directs coring, obtain three cores from the sublot in question. Have an HTCP certified PCC technician I perform or observe core sampling according to AASHTO T 24. Determine core locations, subject to the engineer's approval, that do not interfere with structural steel. Fill all core holes with non-shrink grout.

(4) Have an independent consultant test cores according to AASHTO T 24, except test cores dry after air-curing if the cores are from above-grade concrete elements that will be only superficially wet in service.

(5) If the 3-core average is greater than or equal to 85 % of f'c, and no individual core is less than 75 % of f'c, the engineer will accept the sublot at the previously determined pay for the lot. If the 3-core average is less than 85 % of f'c, or an individual core is less than 75 % of f'c, the engineer may require the contractor to remove and replace the sublot or assess a penalty of $35 per cubic yard or more.

B.7.5 Air Content

(1) On each day of production, test air content at the point of placement at start-up and as frequently as practicable until the concrete meets the specifications and the production process is under control. Subsequently, test air content for each compressive strength sublot. Have an HTCP certified PCC technician I test air content according to AASHTO T 152, as modified by the department. Test concrete taken from the same sample used for QC strength cylinders, and as the engineer directs.

(2) The lower and upper control limits for air content are 4.5% and 7.5%. The lower warning limit for air content is 5.0%. There is no upper warning limit.

B.7.5.1 Documentation

(1) Maintain a control chart at a fixed location on the project site. Ensure that all test results are recorded and become part of the project records. Chart all results on the same day tests are conducted. Record the results of required start-up and corrective action non-random test results on the air content control charts, but do not included them in the 4-point running average.

(2) Document admixture dosage rates, time of day, and air temperature on the combined gradation control chart for the percent passing the No. 200 (75 μm) sieve whenever changing an admixture dosage rate.

B.7.5.2 Corrective Action

(1) If an individual air test is between the lower warning limit and lower control limit, perform non-random testing on as many subsequent loads as possible until an individual test result is above the warning limit. At that point the contractor may resume regular random testing.

(2) When the 4-point running average value trend is towards the lower warning limit or the upper control limit, consider corrective action.

(3) Notify the engineer if a 4-point running average is less than the lower warning limit. If a second consecutive running average is below the warning limit, the engineer and contractor will determine the contractor's course of corrective action. If the corrective action improves the property in question such that the new running average, after 4 additional individual tests, is between the lower warning limit and upper control limit, the contractor may continue production. If the new running average is below the lower warning limit, repeat the steps outlined here in B.7.5.2(3) starting with notifying the engineer.

(4) If an individual air test is outside the control limits, notify the engineer, and perform additional air tests as often as practicable on subsequent loads until the air content is inside the control limits. The material is nonconforming when an individual test exceeds the control limit. Material from the load with the first test exceeding the control limit, continuing to but not including the load with the first subsequent test within the control limits, is nonconforming. The department may direct removal and replacement or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

B.7.6 Concrete Temperature

(1) Have an HTCP certified PCC technician I measure concrete temperature according to AASHTO T 309. Test concrete taken from the same sample used for QC strength cylinders. Record concrete temperatures on the air content control chart. Conform to the hot weather concreting provisions specified in standard spec 501.3.8.2.

B.7.7 Slump

(1) Have an HTCP certified PCC technician I measure slump according to AASHTO T 119. On each day of production, test slump at the point of placement at start-up and as frequently as practicable until the concrete meets the specifications and the production process is under control. Subsequently perform slump testing at the same frequency and from the same sample as used for strength cylinders. Make additional slump tests as the engineer directs. Measure slump to the nearest 1/4 inch (5 mm). Ensure that slump at the point of placement is 3 inches (100 mm) ± 1 inch (25 mm), except, for concrete placed underwater, conform to standard spec 502.3.5.3.

B.8 Department Testing

B.8.1 General

(1) The department will conduct verification testing to validate the quality of the product and independent assurance testing to evaluate the sampling and testing. The department will provide the contractor with a listing of names and telephone numbers of all verification and independent assurance personnel for the project.

(2) Except for strength, the department will provide test results to the contractor within 2 business days after the department obtains the sample.

B.8.2 Verification Testing

(1) The department will have an HTCP technician, or ACT under the direction of a certified technician, perform QV sampling and testing. Department verification testing personnel must meet the same certification level requirements specified for contractor testing personnel for each test result being verified. The department will notify the contractor before sampling so the contractor can observe QV sampling.

(2) The department will sample randomly at locations independent of the contractor’s QC work. In all cases, the department will conduct the verification tests in a separate laboratory and with separate equipment from the contractor's QC tests.

(3) The department will perform verification testing as follows:

	Testing Frequency Guide[1]	Sampling Material and Location	Test Method	Alternate Test Methods
Air Content	1 per lot	Plastic concrete	AASHTO T 152 as modified	Hardened air content testing[2] after construction
28-day Compressive Strength	1 per lot	Cylinders	AASHTO T 22, T 23 & T 141 as modified	Random cores[2] after construction

[1] The engineer may increase the frequency at start-up or as necessary to validate the quality of the materials. The engineer may reduce the frequency based on a history of satisfactory contractor or material performance.

[2] Evaluation of test results should account for systematic differences in testing methods or sampling locations.

(4) Plot verification test results on the contractor's quality control charts as specified in B.6.1.Do not include verification test results in the 4-point running average.

(5) If verification tests conform to specifications, no further action is required. If verification tests do not conform to specifications, the engineer and contractor will jointly investigate any testing discrepancies. The investigation may include additional testing as well as review and observation of both the department's and contractor's sampling and testing procedures and equipment. Both parties will document all investigative work.

(6) Correct all deficiencies. If the contractor does not respond to an engineer request to correct a deficiency or resolve a testing discrepancy, the engineer may suspend production until action is taken. Resolve disputes as specified in B.9.

B.8.3 Independent Assurance Testing

(1) Independence assurance is unbiased testing the department performs to evaluate the department's verification and the contractor's QC sampling and testing including personnel qualifications, procedures, and equipment. The department will perform the independent assurance review according to the department's independent assurance program, which may include one or more of the following:

1. Split sample testing.
2. Proficiency sample testing.
3. Witnessing sampling and testing.
4. Test equipment calibration checks.
5. Reviewing required worksheets and control charts.
6. Requesting that testing personnel perform additional sampling and testing.

(2) Plot the independent assurance test results on the quality control charts as specified in B.6.1. Do not include independent assurance test results in the 4-point running average.

(3) If the department identifies a deficiency, and after further investigation confirms it, correct that deficiency. If the contractor does not correct or fails to cooperate in resolving identified deficiencies, the engineer may suspend production until action is taken. Resolve disputes as specified in B.9.

B.9 Dispute Resolution

(1) The engineer and contractor should make every effort to avoid conflict. If a dispute between some aspect of the contractor's and the engineer's testing program does occur, seek a solution mutually agreeable to the project personnel. The department and contractor may review the data, examine data reduction and analysis methods, evaluate sampling and testing procedures, and perform additional testing. Use ASTM E 178 to evaluate potential statistically outlying data.

(2) If the project personnel cannot resolve a dispute and the dispute affects payment or could result in incorporating nonconforming product, the department will use third party testing to resolve the dispute. The department's central office laboratory or a mutually agreed on independent testing laboratory, will provide this testing. The engineer and contractor will abide by the results of the third party tests. The party in error will pay service charges incurred for testing by an independent laboratory. The department may use third party test results to evaluate the quality of questionable materials and determine the appropriate payment. The department may reject material or otherwise determine the final disposition of nonconforming material as specified in standard spec 106.5.

B.10 Acceptance

(1) The department will accept concrete masonry based on the contractor QC tests unless it is shown through the verification or the dispute resolution process that the contractor's test results are in error.

C (Vacant)

D Measurement

(1) The department will measure Incentive Strength Concrete Structures by the dollar, adjusted as determined in E.3 for acceptably completed concrete masonry.

E Payment

E.1 General

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
502.0400.S	Incentive Strength Concrete Structures	DOL

E.2 QMP Testing

(1) Costs for all sampling, testing, and documentation required under this special provision and all charges incurred for coring, including traffic control, are incidental to the work. If the contractor fails to perform the work required under this special provision, the department

may reduce the contractor's pay. The department will administer pay reduction under the Non-performance of QMP administrative item.

E.3 Pay Adjustment for Strength

(1) The department will pay incentive for compressive strength under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
502.0400.S	Incentive Strength Concrete Structures	DOL

(2) Incentive payment is not limited, either up or down, to the amount the schedule of items shows.

(3) The department will administer disincentives for compressive strength under the Disincentive Strength Concrete Structures administrative item.

(4) The department will adjust pay for each lot using percent within limits (PWL) of the 28-day sublot average strengths for that lot. The department will measure PWL relative to the lower specification limit of 4000 psi. The department will not pay incentive for any quantity of concrete incorporated into the work with properties outside the control limits specified in subsection B of this special provision.

(5) Submit strength results to the department electronically using the MRS software. The department will validate all contractor data before determining pay adjustments.

(6) The department will adjust pay for each lot using equation "QMP 2.01" as follows:

PERCENT WITHIN LIMITS (PWL)	PAY ADJUSTMENT[1][2] (dollars per cubic yard)
≥99 to 100	10
≥90 to <99	0
≥50 to <90	(7/8 x PWL) - 78 3/4
<50	-35

[1] The department will not pay incentive if the lot standard deviation is greater than 350 psi.

[2] For lots with less than four sublots, there is no incentive but the department will assess a disincentive based on the individual sublot average strengths. The department will reduce pay for sublots with an average strength below 4000 psi by $35 per cubic yard.

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